

What Is Claimed Is:

1. An apparatus for detecting foreign particle and defect, comprising :

an illumination optical system to irradiate from different angles a plurality of laser beams having different wavelengths onto a substantially same location of said object;

a detection section to divide and detect the scattered light reflected from the location of said object by each of said wavelengths;

a conversion section to convert the scattered light of the respective detected wavelengths into an electrical signal; and

a discernment section to discern a state of said foreign particle and defect according to said electrical signal of the respective wavelengths,

wherein an irradiation location of the laser beam moves with regard to a surface of the object in detection, according as which point moves, the state of said foreign particle are separately detected from that of said defect.

20 2. An apparatus for detecting foreign particle and defect, comprising :

a stage to support and revolve an object in detection;

an illumination optical system to irradiate from different angles a plurality of laser beams having different wavelengths onto a substantially same location of a surface of said object

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in a simultaneous scanning operation;

a detection section to divide and detect the scattered light reflected from the location of said surface by each of said wavelengths;

5 a conversion section to convert the scattered light of each of said detected wavelengths into an electrical signal; and

a discernment section to discern a state of said foreign particle and defect according to said electrical signal of each of said wavelengths,

wherein the above plurality of laser beams in said simultaneous operation moves with regard to the surface of said object in a spiral manner by a relative movement between said stage and illumination optical system, which allows the state of said foreign particle to be separately detected from that of said defect.

3. An apparatus for detecting foreign particle and defect according to claim 1, wherein said illumination optical system is arranged such that a laser having the plurality of wavelengths that are simultaneously emitted from a multi-oscillation laser luminous source are separated by each of said wavelengths into the laser beams of said different wavelengths.

4. An apparatus for detecting foreign particle and defect according to claim 2, wherein said stage is arranged to move 25 a position of a rotational axis of said object in detection

relative to an irradiation position of said laser beam.

5. An apparatus for detecting foreign particle and defect according to claim 1 wherein an irradiation angle of said laser beam with regard to a vertical line taken on the surface of said object includes a range from substantially 60° to 90° as well as a range from substantially 0° to 30°.

6. A method for detecting foreign particle and defect, comprising the steps of:

irradiating from different angles a plurality of laser beams having different wavelengths onto a substantially same location of an object;

detecting by each of said wavelengths the scattered light reflected from the location of said object;

converting the scattered light of each of said detected wavelengths into an electrical signal; and

discerning a state of foreign particle and defect according to the electrical signal of each of said wavelengths so as to separately detect the state of said foreign particle from that of said defect.

20 7. A method for detecting foreign particle and defect, comprising the steps of:

supporting and revolving an object;

irradiating from different angles a plurality of laser beams having different wavelengths onto a substantially same 25 location of a surface of said object in a simultaneous scanning

operation;

detecting a scattered light reflected from the location
of said surface by each of said wavelengths;

5 converting the scattered light of each of said detected
wavelengths into an electrical signal; and

discerning a state of said foreign particle and defect
according to the electrical signal of each of said wavelengths,
wherein a plurality of laser beams moves relative to the surface
of said object in a spiral manner, which allows the state of
said foreign particle to be separately detected from that of
said defect.

8. An apparatus for detecting foreign particle and defect ,
comprising:

an irradiation means to irradiate a laser beam onto an
object from a plurality of directions; and

15 a detection means to detect a scattered light of the laser
beam reflected from said object by the irradiation of the
irradiation means and to compare signals of said detected
scattered light with one another and to detect a directivity
20 of said scattered light in reflection,

wherein it is arranged such that said directivity allows said
foreign particle and defect to be separately detected.

9. An apparatus for detecting foreign particle and defect ,
comprising:

25 an irradiation means to irradiate a laser beam onto an

object in detection by dividing said beam into a first incident path and a second incident path; and

a detection means to detect a scattered light of said beam reflected from said object in detection in a plurality of directions for each case of said first and second incident paths and to output a directivity of said scattered light in reflection as an electrical signal,

wherein it is arranged such that said foreign particle and defect are separately detected according to said electrical signal as output.

10. An apparatus for detecting foreign particle and defect, comprising:

an irradiation means to irradiate a laser beam onto an object in detection;

15 a first reflection optical system to introduce a scattered light of the laser beam in reflection from said object in detection into a first direction that is substantially vertical with regard to a surface of said object in detection;

20 a second reflection optical system to introduce through a curved mirror said scattered light into a plurality of second directions different from said first direction;

a comparison means to compare a first signal output from said first reflection optical system with a second signal output from said second reflection optical system; and

25 a means to display a result obtained by said comparison

means,

wherein it is arranged such that said foreign particle and defect are separately detected according to a directivity of said scattered light in reflection.

- 5 11. An apparatus for detecting foreign particle and defect, comprising:

an irradiation means to divide an incident path of a laser beam with regard to an object in detection into a first incident path and a second incident path;

10 a first reflection optical system to introduce a scattered light of the laser beam in reflection from said object in detection into a first direction that is substantially vertical with regard to a surface of said object in detection;

15 a second reflection optical system to introduce said scattered light through a curved mirror into a plurality of second directions different from said first direction;

20 a comparison means to compare a first signal output from said first reflection optical system with a second signal output from said second reflection optical system in each case of said first and second incident paths; and

a means to display a result obtained by said comparison means,

wherein said foreign particle and defect are separately detected according to a directivity of said scattered light in reflection.

- 25 12. An apparatus for detecting foreign particle and defect,

comprising:

an irradiation means to divide an incident path of a laser beam with regard to an object in detection into a first incident path and a second incident path;

5 a first reflection optical system to introduce a scattered light of said laser beam in reflection from one of said foreign particle and defect on said object in detection into a first direction that is substantially vertical with regard to said object;

10 a second reflection optical system to introduce said scattered light into a plurality of second directions different from said first direction; and

15 means to sum up a first signal obtained by converting the scattered light of the first optical system introduced into the first direction into photoelectricity and a second signal obtained by converting the scattered light of the second optical system introduced into each of said second directions into photoelectricity and compare a result as summed up in each case of said first and second incident paths,

20 wherein said foreign particle and defect are separately detected according to a directivity of said scattered light in reflection, which directivity is obtained by the comparison result.

13. An apparatus for detecting foreign particle and defect, comprising:

25 an irradiation means to divide an incident path of a laser

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beam with regard to an object into a first incident path and
a second incident path;

a first reflection optical system to introduce a scattered
light in reflection from one of said foreign particle and defect
5 into a first direction that is substantially vertical with regard
to said object;

a second reflection optical system to introduce said
scattered light through a curved mirror into a plurality of second
directions different from said first direction; and

a comparison means to compare a first signal obtained by
converting the scattered light of the first optical system
introduced into the first direction into photoelectricity with
a second signal that is obtained by summing up a signal obtained
by converting the scattered light of the second optical system
into photoelectricity in each of said second directions and a
means to display a result of said comparison,
wherein said foreign particle and defect are separately detected
according to a directivity of said scattered light in reflection.

14. An apparatus for detecting foreign particle and defect
20 according to claim 11 wherein said first incident path is arranged
so that the beam is incident to a substantially vertical direction
with regard to said object in detection.

15. An apparatus for detecting foreign particle and defect
according to claim 11 wherein said irradiation means is arranged
25 to change over the first incident path with the second incident

path.

16. An apparatus for detecting foreign particle and defect according to claim 9 wherein the irradiation means is arranged to separate the laser beam into a first part thereof in reflection and a second part thereof in transmission according to a wavelength of said beam and to simultaneously emit both of said parts.

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17. A method for detecting foreign particle and defect on an object in detection, comprising the steps of :

irradiating a laser beam with regard to an object;
detecting a scattered light of the laser beam reflected from one of said foreign particle and defect in plural directions so as to detect a directivity of said scattered light in reflection;

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outputting said directivity as an electrical signal; and displaying a result of the detected directivity according to said electrical signal,

whereby said foreign particle and defect are separately detected.

18. A method for detecting foreign particle and defect, comprising the steps of:

20
irradiating a laser beam with regard to an object through a first incident path;

detecting a scattered light of the laser beam reflected from said object in plural directions and detecting a directivity of said scattered light as an electrical signal;

25
memorizing a result obtained by detection of the

directivity;

changing over the incident path of the laser beam from
the first incident path to a second incident path;

5 detecting the scattered light reflected from the object
that is irradiated by the laser beam through said second incident
path in plural directions; and

detecting a directivity of said scattered light as an
electric signal; and

10 comparing a result obtained by detection of the directivity
through the second incident path with a result obtained and
memorized by detection of the directivity through the first
incident path,

15 whereby said foreign particle and defect are separately detected
according to the directivity of said scattered light in
reflection.

19. An apparatus for detecting foreign particle and defect ,
comprising:

20 an illumination optical system to irradiate a laser beam
onto a substantially same location of an object from one of a
sole source and a plurality of sources;

a detection section to detect a scattered light reflected
from said object by the irradiation of the laser beam;

a conversion section to convert the detected scattered
light into an electrical signal; and

25 a discernment section to discern a state of said foreign

particle from that of said defect according to signal output characteristics of said scattered light.